ANNUAL REPORT

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BURLINGTON - DRURY LANE

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WATER POLLUTION CONTROL PLANT

OWRC PROJECT NO. 60-S-51

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WATER POLLUTION CONTROL PLANT

PROJECT NO. 60-S-51

OPERATED FOR

THE TOWN OF BURLINGTON

BY

THE ONTARIO WATER RESOURCES COMMISSION

Mr. A. M. Snider	-	Chairman
Dr. A. E. Berry	-	General Manager
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Prepared by the
Division of Plant Operations

GENERAL

A trickling filter sewage treatment plant was built in 1915 in the Town of Burlington on Drury Lane. Sewage was treated by this process until 1954-55 when a 1.25 million gallon per day activated sludge plant was constructed. The new plant was built on a site lying immediately to the north of the old trickling filter plant.

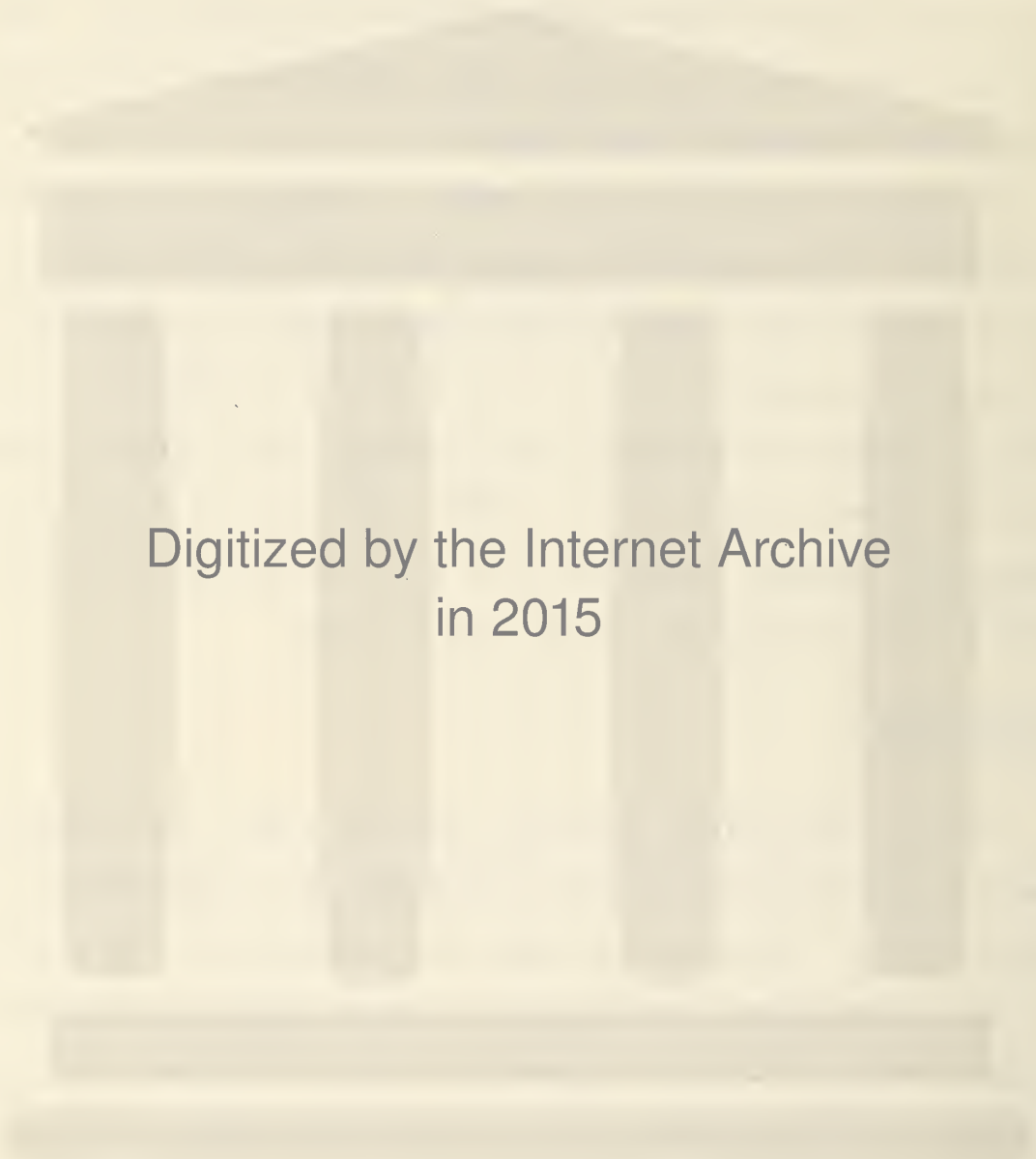
A report was prepared by James F. MacLaren Associates of Toronto in 1958 concerning sewage collection and treatment. It was recommended that the Drury Lane plant be enlarged to 2.5 million gallons per day. The plant was enlarged to 2.5 MGD for complete treatment with provision for primary treatment only for flows from 2.5 to 5.0 MGD. The Ontario Water Resources Commission assumed responsibility for the operation of the expanded plant during the early part of 1961.

DESIGN DATA

The 2.5 MGD water pollution control plant was designed by James F. MacLaren Associates of Toronto and constructed by Frid Construction. Primary treatment is provided for flows up to 5.0 MGD. The plant was designed to give complete treatment of sewage having a BOD and suspended solids of 200 and 180 parts per million respectively and the following range of flows:

Average design rate of flow	-	2.5 MGD
Maximum hourly rate of flow	-	5.0 MGD

(Based on required capacity for primary settling.)



DESIGN DATA - Continued

Maximum monthly rate of flow - 3.8 MGD

(Based on required capacity for secondary settling.)

PLANT DESCRIPTION

(1) Inlet Works

Sewage is pumped to the plant and enters the grit channels through one inch bar screens. The velocity of flow through the channels is maintained at approximately one foot per second by means of proportional weirs at the outlet end. Three channels are provided, one of which is a recent addition, and the capacity is such that any two will accept a flow of 5.0 MGD. The grit and screenings are removed manually to a concrete drain pad and then trucked away.

(2) Primary Sedimentation

From the grit channels the sewage flows by gravity to an influent channel from which it is proportioned between two primary tanks. Normally, the flow to each will be equal but stop logs are provided so that either tank may be isolated.

The primary tanks are both of the rectangular type, each 49.3 feet in length, 18.0 feet wide and have an average depth of 12.25 feet. The total capacity is 21,750 cubic feet (135,700 gallons) giving a retention period of 1.3 hours at design flow. Sludge is moved to hoppers continuously by flight collectors incorporating scum removal blades. From the hoppers, the

collected sludge is pumped to the digesters on an automatic time cycle. The primary tank effluent is discharged over end weirs. The primary tanks are part of the old plant, no additions having been made during the recent expansion with the exception of additional adjustable weirs.

(3) Aeration Section

The primary effluent flows to the aeration tanks through a channel equipped with stop gates to control the flow proportioning. Normally, each of the two aeration tanks get equal flow, but either one may be removed from service.

Each aeration tank is 320 feet long, 18 feet wide and 11 feet deep. The capacity of the combined aeration tanks is 788,000 gallons giving a retention period of 6.05 hours at design flow.

Air supply is by diffusers, 268 2-tube fine assemblies and 82 course type. The blowers are housed in the main control building. The blowers of 750 cubic feet per minute capacity were in the old plant and a new 1500 cfm blower was installed during the recent expansion.

(4) Final Sedimentation

The two circular final tanks were built as part of the expansion program. Each is 50 feet in diameter with a 10.6 foot water depth. The total capacity of the final tanks is 260,000 gallons giving a retention period of 2.5 hours at design flow.

Sludge in the final tanks is continuously removed by "Rex Unitube Tow-Bro" mechanisms which depend on hydro-static

pressure on a rotating header pipe to effect removal. Each revolution of the unit cleans the entire tank bottom, without having to move the sludge to a central hopper. The sludge may be returned to the aeration tank as seed for the process or to the primary tanks for removal to the digesters. Pumping of the return sludge is done by one of two units, each having a capacity of 0.65 MGD against a total head of 28 feet at full speed. The speed and, therefore, the rate of return is variable.

The final effluent flow is metered and chlorination facilities are provided. The effluent is also used in the flushing water system and the spray system for foam control in the aeration tanks. The chlorinated effluent is discharged to a gravity sewer leading to Lake Ontario.

(5) Sludge Digestion

Two stage digestion is provided for the solids before eventual disposal by tank truck to nearby farms.

There are two primary digesters with a total capacity of 50,000 cubic feet and one secondary digester with a capacity of 25,000 cubic feet.

Prior to the expansion of the plant, the two digesters now used as primaries were used as one primary and one secondary. A new secondary digester was built and the two existing tanks were converted to primary digestion.

All three tanks are heated by two dual fuel P.F.T. Heat Exchangers, each with a capacity of 250,000 b.t.u. per hour. The temperature of the sludge is thermostatically controlled.

Pumps are provided for recirculation of the sludge and may be also for transfer of the sludge from one tank to another. Sludge removal or transfer is accomplished by a manually operated positive displacement pump.

OPERATING RESULTS

(1) Loadings and Removals

Table I indicates the flows encountered at the plant. The average daily flow per month reached a maximum of 3.17 MGD during November and a minimum of 1.97 MGD during January. The average daily flow for the year was 2.44 million gallons which is almost equal to the design average daily flow of 2.5 MGD. This represents a 21% increase in the average daily flow as compared with 1961. The total flow for the year was 891.91 million gallons. The flows at the plant have been increasing as shown on Graph III. The aeration section has been overloaded hydraulically at least one day per month as indicated by the line representing the maximum daily flow for the month. The average daily flow during four months exceeded the aeration section's hydraulic capacity of 2.5 MGD. The total flow reaching the plant exceeded the above maximum figures approximately 18% of the time, but are not recorded since only the flow through the aeration section is measured.

Graph II indicates that the daily flows exceeded the design flow (2.5 MGD) 47% of the time and, as indicated in Table I, the aeration section was bypassed 1,521 hours (18% of the time).

On the average, 55 tons of BOD and 80 tons of suspended solids were removed per month. Approximately 2.68 cubic feet of grit (1.1 cubic feet per million gallons) were removed daily.

Graph I indicates the range of concentrations of BOD and suspended solids in the raw sewage, primary effluent and final effluent. Eighty percent of the raw sewage had BOD concentrations from 110 to 300 parts per million and concentrations of suspended solids from 125 to 360 parts per million. Primary treatment decreased the strength of sewage and lessened the variations. Eighty percent of the BOD and suspended solids concentrations in the primary effluent ranged from 84 ppm to 150 ppm and 85 ppm to 160 ppm respectively.

The objectives of the OWRC with respect to concentrations of BOD and SS in the final effluent were exceeded in 80% of the samples taken. However, the average percent reduction through the plant was 88% although, as indicated above, the objectives for final effluent quality were met with only 20% of the samples. The efficiency of the treatment process would have to be increased to give a 96% reduction if the Commission's objectives are to be met most of the time. An average percent reduction of 92 was obtained at the plant until the last three months of the year. The percent reduction during the last portion of the year decreased due to the failure of the blower.

Summary

The concentrations of BOD and SS were representative of a normal domestic sewage except greater variations than normal

were experienced. Several samples had concentrations above 300 ppm and this is indicative of industrial wastes.

The average daily flow for the year was only slightly less than the design flow with the design flow being exceeded 47% of the time (Graph II). Fluctuations in flow cause difficulties in the operation of the plant and it is most necessary that surges be kept to a minimum. It is estimated that some of the daily flows approached 7 MGD as only the flow obtaining complete treatment was measured.

The heavy flows and in particular surges resulted in a treatment efficiency of 88% rather than an expected efficiency of from 90 to 95%.

(2) Aeration Section

Table III indicates the loading on the aeration section. The ratio of pounds of BOD per 100 pounds of aeration varied considerably during the year as it was difficult for the operator to maintain the proper ratio due to flow variations. The best results were obtained during the month of September at which time the maximum daily flow (Table I) was 3.01 MG with the average being 2.09 MG. A 94 and 97 percent reduction in BOD and S.S. was obtained during September.

Some experimentation was carried out during August with the biosorption and sludge reaeration processes. However, due to the lack of facilities for handling the activated sludge, it was decided to revert to the conventional process.

(3) Sludge Digestion

Table IV indicates the volumes of raw and digested sludge entering and leaving the digester respectively. Better than average concentration of solids was realized in the digester during the year. The digested sludge on the average was concentrated to 6.1 percent as compared with an average of 5 experienced at other similar plants.

PLANT ADMINISTRATION

Responsibility for the operation of the plant rests with the Ontario Water Resources Commission through the Division of Plant Operations. Operation of the plant was carried out during the year by a chief operator (Mr. J. McNamara) and four operators (Messrs. Blazek, Cunning, Stinson and Carmichael).

Mechanical and electrical technicians are available from head office to assist the plant staff. During the year, 108 man hours were spent at the plant in inspection and service work by the head office technicians.

Operation of the plant was hindered during the year by high and fluctuating flows. The operators were, however, able to maintain an 88% efficiency with respect to the treatment provided by the plant. During the latter part of the year, increased concentrations of feathers were noted in the raw sewage. This condition at times threatened to develop to such a point that 24 hour supervision could have been required.

One of the air blowers at the plant required new bearings during the latter part of the year. The blower housing was distorted and the remaining life of the unit is rather short. Cost of repairing the unit was estimated to be almost as much as a new blower. The blower was placed in service and it is expected that it will operate satisfactorily until the new Skyway plant is placed in operation.

YEAR	MG TREATED	TOTAL COST	COST PER 1000 GALS.	COST/LB BOD REMOVED	COST/LB SS REMOVED
*1961	258.6	$21,416.00	8.3¢	5.2¢	4.3¢
1962	891.9	41,983.20	4.7	3.5	2.4

* The plant was not in operation for a full year and costs were based on the period from August to December.

RECOMMENDATIONS

1. The plant is overloaded hydraulically much of the time. However, the Skyway Water Pollution Control Plant scheduled for completion during 1963 will lessen the hydraulic load. Every effort should be made until the completion of the new plant to maintain a flow with the minimum of variations.

2. The addition of feathers to the sewage should be discouraged. Any increase in the amount of feathers presently received at the plant could necessitate 24 hour supervision.

3. Further consideration should be given to the possibility of operating the plant with sludge reaeration.

4. The blower with the distorted housing is expected to operate until the new plant is completed. It is possible that this blower will be required only as a standby at that time and, therefore, it would not be necessary to replace it.

OPERATING EXPENSES 1962

ITEM	ESTIMATE	ACTUAL	DIFFERENCE
Payroll	$ 23,500	$ 21,926.51	+ 1,573.49
Fuel	2,000	597.58	+ 1,402.42
Power	6,000	8,543.03	- 2,543.03
Chemical	3,200	2,580.36	+ 619.64
General Supplies	1,600	2,249.51	- 649.51
Equipment	800	638.78	+ 161.22
Repair and Maintenance	600	46.95	+ 553.05
Sundry	9,900	5,256.05	+ 4,643.95
Water	400	144.43	+ 255.57
	$ 48,000	$ 41,983.20	+ 6,016.80

PAYROLL

Estimate - $23,500 Actual - $21,926.51 Difference - $1,573.49

A surplus of $1,573 was realized in payroll due to an expenditure of only $232.72 for casual labour as compared with an estimate of $1,152 and due to no pension contributions by some of the staff.

FUEL

Estimate - $2,000 Actual - $597.58 Difference - $1,402.42

At the beginning of 1962, the digester gas production was approximately 2,500 cubic feet per day and it was necessary to use approximately 20 gallons of fuel oil per day for heating. However, gas production increased quite rapidly so that by the beginning of May approximately 10,000 cubic feet per day were produced and no fuel oil was required for heating. The gas production levelled off at approximately 20,000 cubic feet per day and fuel oil was not required during the latter portion of the year.

POWER

Estimate - $6,000 Actual - $8,543.03 Difference - $2,543.03

The increased power costs have resulted from increased pumping and aeration which has been necessitated due to the 21% increase in average daily flow.

CHEMICAL

Estimate - $3,200 Actual - $2,580.36 Difference - $619.64

The chlorine dosage required to maintain a residual was not as high as anticipated.

GENERAL SUPPLIES

Estimate - $1,600 Actual - $2,249.51 Difference - $649.51

Many of the items recorded under general supplies were in reality for repair and maintenance. The estimate for both

General Supplies and Repair and Maintenance was $2,200 and the actual expenditures under these two headings was $2,296.

EQUIPMENT

Estimate - $800 Actual - $638.78 Difference - $161.22

REPAIR & MAINTENANCE

Estimate - $600 Actual - $ 46.95 Difference - $553.05

Many of the items purchased as replacement parts appear under General Supplies.

SUNDRY

Estimate - $9,900 Actual - $5,256.05 Difference - $4,643.95

Sludge haulage was estimated to cost $6,000 and the actual costs were $3,367. This difference resulted from a better than average concentration of the solids in the digester and from storage in the digesters.

TABLE I

FLOW RECORDS MGD

MONTH	ABSOLUTE MAXIMUM	ABSOLUTE MINIMUM	MAXIMUM 24 HOUR FLOW	AVERAGE 24 HOUR FLOW	MINIMUM 24 HOUR	TOTAL MONTHLY FLOW MG	PRIMARY BY-PASS (HOURS)
JANUARY	4.2	0.4	2.64	1.97	1.72	60.97	19
FEBRUARY	4.0	0.6	3.26	2.16	1.77	60.53	35
MARCH *	3.1	0.7		2.63		81.46	201
APRIL *	3.0	0.6		2.45		73.40	195
MAY *	3.2	0.4		2.39		74.05	156
JUNE*	3.2	0.5		2.24		67.15	198
JULY	4.1	1.0	2.88	2.25	1.91	69.67	36
AUGUST	4.0	0.4	2.83	2.13	1.82	65.94	22
SEPTEMBER	4.1	0.4	3.01	2.09	1.59	62.69	41
OCTOBER	4.0	0.7	3.74	2.98	2.00	92.43	214
NOVEMBER	3.8	0.6	3.58	3.17	2.76	95.00	268
DECEMBER	4.0	0.8	3.72	2.86	2.38	88.62	136
TOTAL	44.7	7.1	25.66	29.32	15.95	891.91	1521
AVERAGE PER MONTH	3.7	0.6	3.21	2.44	1.99	74.32	127

* METER WAS OUT OF SERVICE, THEREFORE, FLOWS ARE PRO-RATED.

TABLE II

GRIT, BOD AND SS REMOVAL

MONTH	B O D				S S				GRIT REMOVAL	
	INFLUENT PPM	EFFLUENT PPM	% REDUCTION	TONS REMOVED	INFLUENT PPM	EFFLUENT PPM	% REDUCTION	TONS REMOVED	CU.FT.	PER MG SEWAGE
JANUARY									40	0.7
FEBRUARY	154	13	92	43	212	28	87	56	40	0.7
MARCH	155	20	87	55*	240	39	84	82	85	1.0*
APRIL	327	20	94	113*	722	45	94	248	105	1.4*
MAY	125	16	87	40*	167	26	84	52	87	1.2*
JUNE	115	22	81	31*	144	14	90	44	137	2.0*
JULY	165	16	90	52	256	14	94	84	50	0.7
AUGUST	199	6	97	64	174	44	75	43	78	1.2
SEPTEMBER	189	12	94	56	285	10	97	86	62	1.0
OCTOBER	142	15	89	59	160	13	92	68	93	1.0
NOVEMBER	109	30	72	38	139	20	86	57	119	1.3
DECEMBER	143	21	85	54	163	16	90	65	63	0.7
TOTAL	1823	191	968	605	2662	239	973	885	959	12.9
AVERAGE PER MONTH	166	17	88	55	242	22	88	80	80	1.1

* BASED ON ESTIMATED FLOWS.

TABLE III

AERATION SECTION

MONTH	PRIM. EFFL. BOD PPM	M.L. S.S. (PPM)	LBS. OF BOD PER 100 LBS. M.L.S.S.	BOD REMOVED (TONS)	CU.FT. AIR PER LB. BOD REMOVED	CU.FT. AIR PER GAL. OF SEWAGE
JANUARY		992				
FEBRUARY	114	1,061	30	31*	1,800	1.8
MARCH	103	1,322	27*	34*	1,191*	1.0*
APRIL	133	1,641	25*	42*	1,423*	1.6*
MAY	84	1,360	19*	25*	2,509*	1.7*
JUNE	89	996	25*	23*	2,851*	1.9*
JULY	82	1,665	14	23	1,428	1.9
AUGUST	108	3,294	9	34	2,012	2.0
SEPTEMBER	101	1,734	15	28	2,681	2.0
OCTOBER	126	1,483	31	51	1,156	1.3
NOVEMBER	87	1,749	20	27	1,860	1.2
DECEMBER	128	1,784	25	47	1,067	1.2
TOTAL	1,155	19,081	240	365	19,978	17.6
AVERAGE	105	1,590	22	33	1,816	1.6

NOTE:

* Based on Estimated Flows.

FSIWA Manual of Practice No. 8 Recommends a BOD/100 lbs. SS loading of from 20 to 30 lbs.

TABLE IV

DIGESTER OPERATION

MONTH	SLUDGE TO DIGESTER			DIGESTED SLUDGE			DIGESTER TEMP.	GAS PRODUCED CU.FT.
	GAL.	% SOLIDS	TONS	GAL.	% SOLIDS	TONS		
JANUARY	199,380	3.3	33	86,429	4.4	19.0	92	68,328
FEBRUARY	184,260	2.9	27	39,424	4.93	9.7	92	116,392
MARCH	228,468	3.6	41	1,516	5.72	0.4	96	174,445
APRIL	263,100	3.7	49	24,260	6.3	7.6	94	316,591
MAY	210,572	3.9	41	80,534	6.1	24.4	87	803,668
JUNE	385,448	4.2	81	70,762	6.3	22.3	92	647,932
JULY	286,135	4.0	58	141,018	6.7	47.3		606,966
AUGUST	363,498	3.8	69	136,132	6.48	43.1		664,123
SEPTEMBER	309,847	3.5	54	22,576	6.6	7.4		684,966
OCTOBER	293,604	4.32	63	90,006	5.81	26.1		704,278
NOVEMBER	221,621	5.67	63	89,716	6.44	28.9		546,022
DECEMBER	230,732	3.74	43	50,123	7.56	19.0		599,580
TOTAL	3,176,665		622	832,495		195.		5,933,291
AVERAGE	264,000	3.9			6.1			

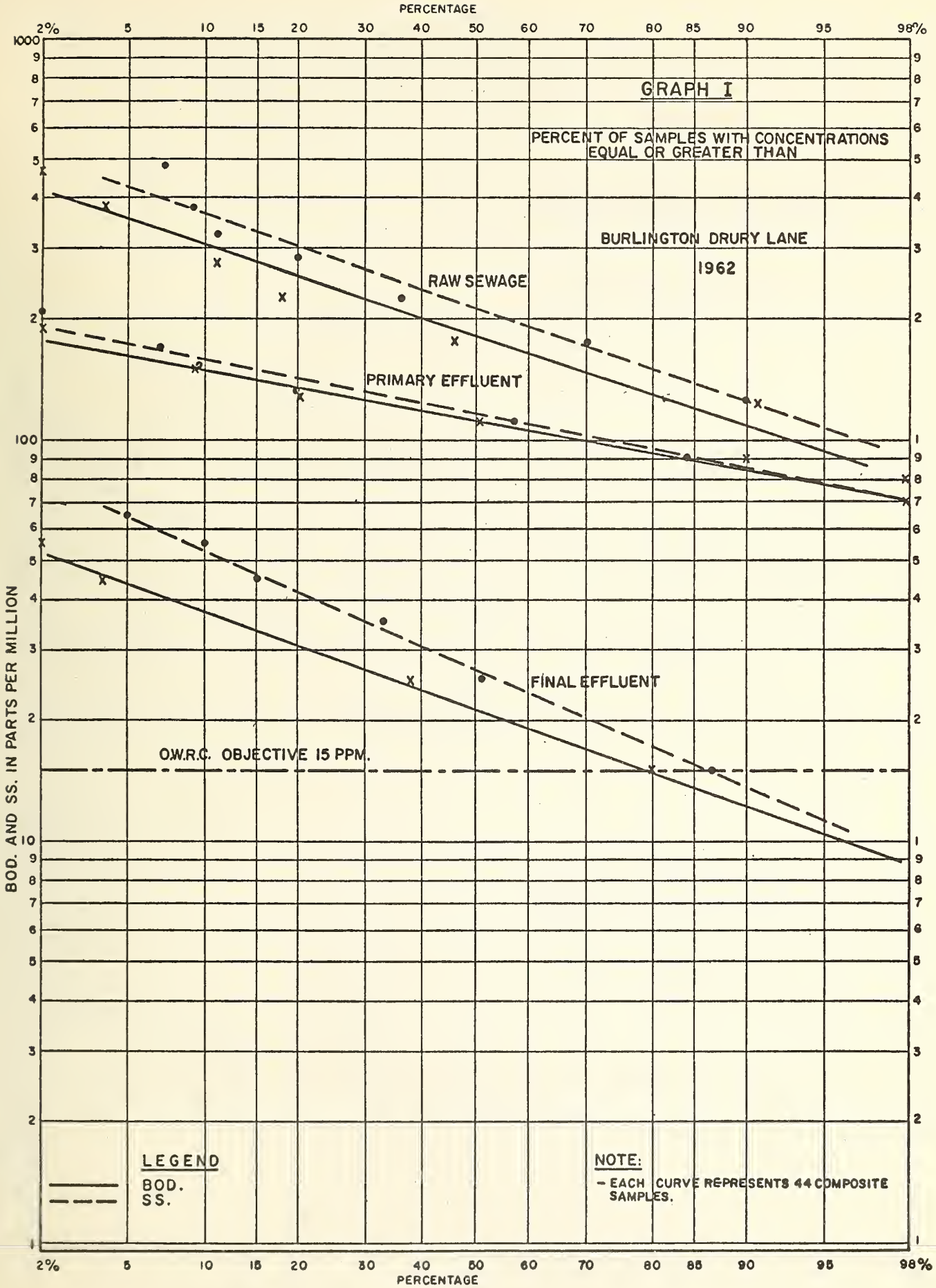
TABLE V

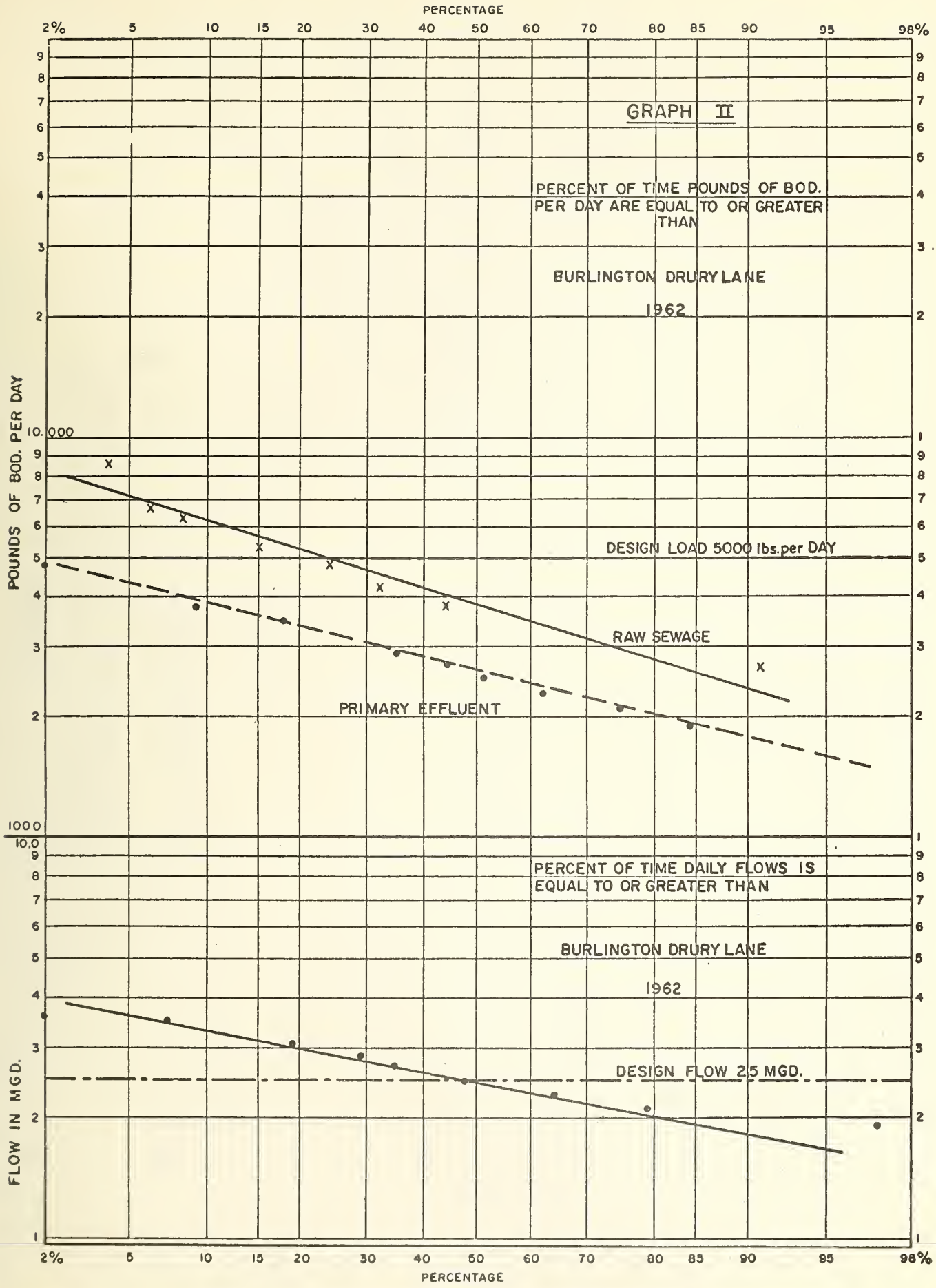
PROJECT OPERATION STATEMENTS

MONTH	EXPENDITURE	PAYROLL	CASUAL PAYROLL	FUEL	POWER	CHEMICAL	GENERAL SUPPLIES	EQUIPMENT	REPAIR & MAINT.	WATER	SUNDRY	ACTUAL ACCUMULATED EXPENDITURE	ACCUM. BUDGET
JANUARY	2,378.54	1,560.21		173.85	447.03		125.46	9.24	37.45	30.80	30.50	2,379	4,333
FEBRUARY	2,277.75	1,560.20		60.74	797.66	665.00	65.32				458.83	4,657 -	8,666
MARCH	3,401.22	1,548.93		76.00	842.61	597.91	169.24			19.50	147.03	8,058	13,000
APRIL	2,005.38	1,548.93		163.33			97.94				195.18	10,063	17,333
MAY	3,499.31	1,548.94		49.63	567.82	637.18	234.50		(37.45)	19.50	479.19	13,562	21,666
JUNE	4,455.64	2,087.22			659.08	574.03	339.88	126.89			668.54	18,018	26,000
JULY													
AUGUST	4,291.10	2,497.92	89.76		668.44	541.00	68.33				425.65	25,848	34,666
SEPTEMBER	2,814.55	1,665.28	87.64		1,454.10		147.50		46.95	20.52	674.25	28,662	39,000
OCTOBER	2,625.56	1,725.85		110.03		33.64	189.46	(10.00)			576.58	31,288	43,333
NOVEMBER	5,211.42	1,699.90			1,594.57	856.60	160.17			16.10	884.08	36,499	47,667
DECEMBER	5,484.05	2,585.13			769.69	453.64	526.83	505.83		17.00	626.44	41,983	52,000
TOTAL	41,983.20	21,693.79	232.72	597.58	8,543.03	2,580.36	2,249.51	638.78	46.95		5,256.05		
AVERAGE PER MONTH	3,500.00	1,805.00			710.00	215.00	187.00						

NOTE:

( ) DENOTES CREDIT.


GRAPH I
PERCENT OF SAMPLES WITH CONCENTRATIONS EQUAL OR GREATER THAN
BURLINGTON DRURY LANE
1962
RAW SEWAGE
PRIMARY EFFLUENT
FINAL EFFLUENT
O.W.R.C. OBJECTIVE 15 PPM.
BOD. AND SS. IN PARTS PER MILLION
PERCENTAGE
2% 5 10 15 20 30 40 50 60 70 80 85 90 95 98%
1000 9 8 7 6 5 4 3 2 100 9 8 7 6 5 4 3 2 10 9 8 7 6 5 4 3 2 1
LEGEND
BOD.
SS.
NOTE:
- EACH CURVE REPRESENTS 44 COMPOSITE SAMPLES.


PERCENTAGE
2% 5 10 15 20 30 40 50 60 70 80 85 90 95 98%
GRAPH II
PERCENT OF TIME POUNDS OF BOD. PER DAY ARE EQUAL TO OR GREATER THAN
BURLINGTON DRURY LANE
1962
POUNDS OF BOD. PER DAY
10,000
DESIGN LOAD 5000 lbs.per DAY
RAW SEWAGE
PRIMARY EFFLUENT
1000
PERCENT OF TIME DAILY FLOWS IS EQUAL TO OR GREATER THAN
BURLINGTON DRURY LANE
1962
FLOW IN M.G.D.
DESIGN FLOW 2.5 MGD.
PERCENTAGE
PERCENT OF TIME BOD. IS EQUAL TO OR GREATER THAN

GRAPH III

MAXIMUM DAILY FLOW DURING THE MONTH AND THE AVERAGE DAILY FLOW PER MONTH THROUGH THE AERATION SECTION.